Claims

1. Dosing equipment for quantitative dosing of small amounts of liquids, comprising a body (1), a flexible bellows (5) attached to the body and defining a liquid space (15), a dosing tip (19) communicating with the liquid space, and an actuator (7) for moving the bellows so that constriction of the liquid space causes a dose to be discharged from the dosing tip, **characterized** in that the actuator (7) is formed of two parts (8, 9) moving relative to one another and acting magnetically on each other, one of the parts being attached to the body (1) of the device and the other being connected to the movable bellows (5), one of said parts being a current coil (9) to let the movements of the bellows be generated by changing the magnitude of the electric current passing through the coil.

2. Device according to Claim 1, **characterized** in that the actuator is formed of a permanent magnet (8) attached to the body (1) of the device, and a current coil (9) adjusted to the movable end (6) of the bellows (5).

3. Device according to Claim 1, **characterized** in that the actuator is formed of a current coil (9) attached to the body (1) of the device, and a permanent magnet (8) adjusted to the movable end (6) of the bellows (5).

4. Device according to any of the above claims, **characterized** in that said device is provided with a flexible centralizer (13) between the body (1) and the moving parts of the device to linearize the movements of the end (6) of the bellows.

5. Device according to Claim 4, **characterized** in that the centralizer (13) is formed of three or more equally spaced parallel helical springs (14) surrounding the moving parts of the device.

6. Device according to Claim 4 or 5, **characterized** in that the spring forces of the centralizer (13) and the bellows (5) have a resultant balancing the end (6) of the bellows at a position, on both sides of which said end (6) may move depending on the direction of the electric current in the current coil.

7. Device according to Claim 6, **characterized** in that the balance position of the end (6) of the bellows lies in the middle of the linear path thereof.

8. Device of any of the above claims, **characterized** in that the body (1) of the device comprises a cylindrical jacket (4), the bellows (5) and the moving part of the actuator (7) being axially arranged in sequence in the space defined by the jacket.

9. Device of any of the above claims, **characterized** in that the liquid space (15) defined by the bellows (5) is provided with a separate filling channel (16) for the liquid to be dosed.

10. Method for quantitative dosing of small amounts of liquids, wherein a flexible bellows (5) defining a liquid space (15) is moved by an actuator (7) connected thereto to constrict the liquid space for discharging a dose from a dosing tip (19) communicating with the liquid space, **characterized** in that the actuator (7) is formed of a magnet (8) and a current coil (9) co-operating therewith, one of said parts being stationarily installed and the other moving the bellows (5), the dosing being carried out by changing the magnitude of the electric current passing through the coil, so that the resulting shifting of the magnet and the coil relative to each other generates the dosing movement of the bellows.

11. Method according to Claim 10, **characterized** in that the dosing is carried out from the dosing tip (19) as droplets into the air.

12. Method according to Claim 11, **characterized** in that the magnitude of the electric current passing through the coil (9) is changed to set the end (6) of the bellows to an accelerated motion, and thereafter, by changing the electric current a new but in the opposite direction, this second change being smaller than the first change, the motion of the end of the bellows is slowed down, thereby to give a specific initial acceleration to the liquid to be dosed from the dosing tip (19) in the first step, and to cause a sharp separation of the liquid droplet from the dosing tip by braking action in the second step.

13. Method according to Claim 12, **characterized** in that the volume of the liquid droplet to be dosed is from 10 nl to 40 µl, preferably from 20 nl to 1 µl.

14. Method according to any of the Claims 10 – 13, **characterized** in that the dosing comprises a serial dosing carried out by means of repeated movements of the bellows (5) in one direction.

15. Method according to Claim 14, **characterized** in that during the serial dosing, a flexible centralizer (14) acts on the end (6) of the bellows moved by the actuator (7) causing the resultant of the spring forces of the bellows and the centralizer to pass by a zero position at which the direction of the electric current passing through the coil (9) is reversed.

16. Method according to any of the Claims 10 – 15, **characterized** in that several parallel dosing bellows (5) are moved by the actuator (7) simultaneously to carry out a serial dosing of matrix type.

17. Method for quantitative dosing of small amounts of liquids, wherein a flexible bellows (5) defining a liquid space (15) is moved by an actuator (7) connected thereto to constrict the liquid space for discharging a dose from a dosing tip (19) communicating with the liquid space, **characterized** in that the dosing is carried out as dosing of droplets from the dosing tip (19) into the air by means of an actuator (7) driven by electric current comprising the first step of setting the end (6) of the bellows to an accelerated motion by changing the magnitude of the electric current passed to the actuator to give a specific initial acceleration to the liquid to be dosed from the dosing tip, followed by the second step of slowing down the motion of the end of the bellows by changing the magnitude of said electric current in the opposite direction to cause a sharp separation of a liquid droplet from the dosing tip.

18. Method according to Claim 17, **characterized** in that the dosing comprises a serial dosing wherein change of the electric current in opposite direction in each second step is smaller than the preceding change in the respective first step.

19. Method according to Claim 17 or 18, **characterized** in that the volume of the liquid droplet to be dosed is from 10 nl to 40 µl, preferably from 20 nl to 1 µl.